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ABSTRACT

In this study 27 third graders and 27 sixth graders were given varying degrees of practice in sorting salient, categorized word lists. The purpose of the practice conditions was to encourage different levels of grouping strategies in a subsequent free recall task using similar categorized materials. Children in a Materials Only condition were allowed to read through practice materials before the memory recall task. Subjects in a Maximal Practice condition were given two practice trials and told that grouping words that "belong" together improves later memory recall; corrective feedback was given to facilitate the use of optimal sorting strategies. Subjects in a Within Subjects Practice condition received no sorting instruction or feedback for their first practice trial, but received both during the second. Findings on one measure of several measures taken are reported here: total number of unique items rehearsed together per rehearsal set. The overall pattern of results suggests that, for younger children, optimal practice in mnemonic strategies includes instruction and feedback cues. In addition to using the same practice cues, older children seem to use a metamemorial component (when available) to facilitate their memory performance. (RH)

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The Role of Practice in Memory Skill Development

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Research investigating memory development during the elementary school years has produced a rather consistent pattern of age-related differences in memory performance. Older children consistently outperform younger children in a variety of memory tasks like free recall (Cole, Frankel & Sharp, 1971) recognition memory (Dirks & Neisser, 1977) and inferencing (Paris & Upton, 1976). To explain these memorial differences, some investigators have studied the development of mnemonic strategies such as verbal rehearsal and organization. For example, by using an overt rehearsal procedure in a free recall task, Naus, Ornstein, and their colleagues (1978) found that older children rehearsed several words together in a cumulative fashion (active rehearsal) whereas, younger children tended to rehearse fewer words together (passive rehearsal). Studies that focus on spontaneous organization as a mnemonic strategy find that younger children don't employ organizational strategies as easily or as consistently as older children when recall is explicitly requested (Lange, 1978; Moely, 1977; Ornstein & Corsale, 1979). Further training studies by these researchers have established a causal link between age changes in both rehearsal and sorting strategies and recall performance.

Although the studies mentioned above provide descriptive data as to how strategies and memory performance change with age, this research fails to suggest a mechanism to account for these developmental changes. More specifically, what is the mechanism that promotes the child's progress from a very inept and inefficient user of strategies to an efficient and more automatic processor of information? The present study tests the hypothesis that a child's mnemonic abilities develop through practice accompanied by minimal instruction. This view suggests that, given an appropriate developmental level of the child, practice in the use of mnemonic skills enables the young child to recognize the

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usefulness of these skills and to successfully employ them across a variety of settings.

At this point it is necessary to elaborate upon the distinction between practice alone and practice accompanied by specific training. In the traditional development training studies (i.e., Ornstein, Naus & Stone, 1977; Pressley & Levin, 1978; Ghatala, Levin, Pressley & Lodico, 1985) younger children are instructed and taught to use a particular mnemonic strategy, thought to improve memory performance, which is found to be absent or inefficient in their spontaneous memorial repetoire. The strategy is taught with epxlicit instruction and feedback until a specific amount of time is over or until some number of trials to successful performance has been completed. The child is then given the same task without the structured training and performance is evaluated to determine whether the child uses the specific strategy on the task without further explicit prompting and, if so, whether improvement in memory performance is also found. While develomental findings have shown general improvements in immediate memory performance (e.g., Naus, Ornstein, & Aviano, 1977; Bjorklund, Ornstein & Haig, 1977; Moynahan, 1978), there is less of an improvement on the child's efficient and continued use of the strategy over even rather short retention intervals. Additional studies show that given the same task after some period of time, or given a different task that requires the implementation of the same strategy for success (transfer task), the child's spontaneous use of the trained strategy decreases rapidly (Keeney, Cannizzo & Flavell, 1967; Pressley & Dennis-Rounds, 1980; O'Sullivan & Pressley, 1984).

These training studies differ from an approach suggested in the present experiment where the child is provided only with an opportunity to practice a

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given strategy over trials without any specific training. Under practice conditions children of different ages are given a particular task which affords them the opportunity to use a given strategy over trials. Strategy usage during this practice time is monitored and then a test is administered to determine whether practice with a given study skill enables the child to use the strategy successfully in a variety of memory tasks. The practice experiences may differ in the way in which practice is distributed (massed vs. distributed), in the type of practice provided (materials only, strategy only, or both) or in the number of memory cues available to the child (instruction, feedback). This practice opportunity most closely simulates the normal acquisition of memorial skill in children since in typical school settings children are provided with a learning experience, and are required to perform memory operations without much specific training on how to memorize. Given these conditions, it seems that over trials, children begin to pick up on the necessary skills for successful performance without much specific memory information. Our goal, then, is to investigate the role of practice in the natural development of mnemonic skill in young children or, more specifically, the optimal practice conditions under which young children most efficiently develop memory skills. Ideally this research would involve a variety of conditions in which children of different ages would practice a particular memory skill over many, many trials until they begin to use the strategy efficiently. Unfortunately, however, since time does not easily permit extensive studies employing this type of within-subjects design, the present experiment manipulated practice conditions by providing children of different ages with a variety of levels of memory cues during their acquisition of the to-be-remembered materials. As operationalized here, then, the manipulation

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is one involving the quality, rather then simply the quantity, of the practice trials provided.

The design of the present study can be seen in Figure 1. In this study

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Insert Figure 1 about here

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27 third graders and 27 sixth graders participated in one of three conditions designed to provide varying degrees of practice in sorting salient, categorized lists during an initial study phase. The purpose of these practice conditions was to encourage different levels of grouping strategies in a subsequent free recall task using similar categorized materials. In each condition the subject was exposed to two sorting/recall practice trials followed by two free recall test trials. Children in a Materials Only condition were allowed only to read through the practice materials before the actual memory recall task. In this condition the children had exposure only to the materials and not to the grouping strategy. Subjects in a Maximal Practice condition were given two practice trials and told that grouping words together that "belong" together improves later memory recall. In addition to these sorting instructions and this actual practice in sorting, corrective feedback was provided to facilitate the use of optimal sorting strategies. Even though there was some instruction on how to sort material in the practice trials, there was no indication given that this strategy would be helpful during the test task. Instruction was only used to facilitate this practice experience. Finally, subjects in a Within Subjects Practice condition received no sorting instruction or feedback for their first practice trial, but received both during the second. This condition allowed the subjects to infer for themselves the importance of grouping the words together to aid in subsequent remembering. Once again, the sorting instructions

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were merely to facilitate the practice experience in these few trials and not to instruct the child on his test performance.

The free recall results for the actual memory task are displayed in Panels A and B of Figure 2. For both third and sixth graders, recall improved

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Insert Figure 2 about here
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across trials in all conditions. For Trial 1, both third and sixth graders recalled more items in the Maximal Practice condition. In contrast, in Trial 1 both third and sixth graders recalled more items in the Maximal Practice condition. In contrast, in Trial 2 third graders recalled more items in the Maximal Practice condition and sixth graders recalled most in the Within Subjects Practice condition. While several rehearsal measures were assessed to evaluate the study strategies used under a different condition, only one measure, the total number of unique items rehearsed together per rehearsal set, is reported here. These rehearsal data can be seen in both panels of Figure 3.

Insert Figure 3 about here

The number of unique items rehearsed does not change significantly across trials. Third graders rehearsed more unique items in the Maximal Practice condition for both trials and interestingly, sixth graders rehearsed more unique items in the Materials Only condition for both trials. A category cluster measure was also obtained to assess the degree of influence the sorting practice had on subsequent recall. The mean number of category clusters in the recall protocols was calculated for each condition. A cluster was defined as two or more words belonging to the same categorical group (tools, animals, etc.). Panels A and B of Figure 4 shows that clustering improved across trials for

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Insert Figure 4 about here

both grades. Third graders clustered their recall most in the Maximal Practice and Within Subjects Practice conditions and sixth graders clustered more frequently in the same two conditions. The most dramatic improvement for the sixth graders in clustering from Trial 1 to Trial 2 was in the Within Subjects Practice condition. The overall pattern of results suggest that for younger children optimal practice in mnemonic strategies includes instruction and feedback cues. In addition to utilizing the same practice cues, older children seem to utilize a metamemorial component (when available) to facilitate their memory performance.

The findings of this study may help to gain a better understanding of the importance of practice in the developmental progression of study strategies from rather primitive subject-controlled, effortful strategies to quite efficient, automatic routines (Shiffrin & Schneider, 1977; Naus & Halasz, 1979). Figure 5 presents a continuum which was originally proposed by Ornstein,

Insert Figure 5 about here

Baker-Ward, & Naus (in press) to outline a framework within which the development of mnemonic skill can be viewed. This continuum described the steps involved in the development of children's study skills from the first effortful applications of memory skill in a limited domain to automatic and efficient utilization of memory skill in a limited domain to automatic and efficient utilization of memory skill in a broad array of memory situations. This continuum accounts for additional memory components that may influence the use of memory strategies such as knowledge base and metamemory. It does not, however, suggest possible

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mechanisms to promote development. Perhaps it is through different conditions of practice and experience that change occurs. Studying the performance of children in the uses of a simple strategy over many trials may allow us to follow and observe how particular memory skills become more automatic. Further, as we begin to systematically study the effects of practice on memory skill development, the factors which enhance a practice session may be better understood. Additional research is necessary to begin to understand under what instructional conditions and supportive contexts practice optimizes the automatization of mnemonic abilities. Ideally, then, on the basis of this work one could combine the most advantageous task conditions and the effects of practice to design an optimal training procedure both for use in the laboratory and in a wide variety of educational settings.

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